Space Weather Technical Forecast

Issued on Tuesday, 30 August 2022 at 12:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of further M-flares (R1-R2 Blackouts).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Moderate, with three M-class flares, all from ex-AR3088, which is now beyond the southwestern horizon, but with looping from the region evident above the limb. The peak flare was M4.7 at 29/1857UTC. There are two active regions on the visible disc. AR3089 (Ekc/Beta-Gamma Delta) is the most significant and despite continuing to develop in complexity, this region has been relatively inactive. AR3086 (Axx/Alpha) has almost faded to plage. No Earth-directed CMEs are evident on available imagery, however a filament eruption was observed just to the northwest of AR3089 at around 29/1415 UTC. This will be analysed once sufficient coronagraph imagery becomes available.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, showed a steady trend for the first half of the period, with solar wind speeds averaging around 525km/s due to a possible combination of a CME arrival early on 29 August and the onset of the high speed stream from coronal hole 17. The speed then spiked at 600km/s around 30/0000UTC before a steady increase, reaching close to sustained speeds of 600km/s by the end of the period. Density has been around average throughout, but with a peak of 14 ppcc around 30/0000UTC, possibly due to a transient feature of the CME. Total magnetic field strength had been mainly moderate, with weak interludes, but with a sustained increase from 30/0600UTC, to reach 30/1100UTC by the end of the period. The north-south component, Bz generally varied weakly, but with a moderate positive peak of around 9nT towards the end of the period. Phi angle was mainly negative (towards the Sun). Geomagnetic activity was mainly Quiet to Unsettled, with one Active interval 30/0300-0600 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16 has been below the S1/Minor Radiation storm level and has fallen towards background. The high energy electron flux (greater than 2 MeV) remained at background levels. The 24-hour integrated electron fluence remained below the Active threshold (1e8 integrated pfu) with 1.09e6 integrated pfu observed at 30/0000 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary
Solar Activity: There is a chance of Moderate solar activity, initially from ex-AR3088 just over the southwest limb, and then from the relatively inactive, but magnetically complex AR3089 in south-centre disc.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs, however a filament eruption from the south-centre disc will be analysed once further imagery becomes available. Solar winds are currently elevated due to CH17/-, but are expected to ease during days 3 and 4 (01 and 02 September). No further solar wind enhancements are forecast. Geomagnetic activity is currently expected to be mostly Quiet with isolated Unsettled spells. There is a slight chance of Active intervals and a very slight chance of G1/Minor storms on days 1 and 2 (30 and 31 August) due mainly to the solar wind enhancements in any periods of sustained negative Bz.

Energetic Particles / Solar Radiation: High energy protons (greater than 10MeV) are expected to remain below the S1/Minor radiation storm levels, but with a chance of further enhancements, mainly from any significant flares from AR3088 on days 1 and 2 (30 and 31 August). AR3089 will also present a risk as it moves across the western disc. The high energy (greater than 2 MeV) electron flux forecast is expected to remain mostly at background, but perhaps rising to moderate with a slight chance of peaking at high, as current fast winds ease. The associated 24 hour fluence is expected to remain below the Active threshold.

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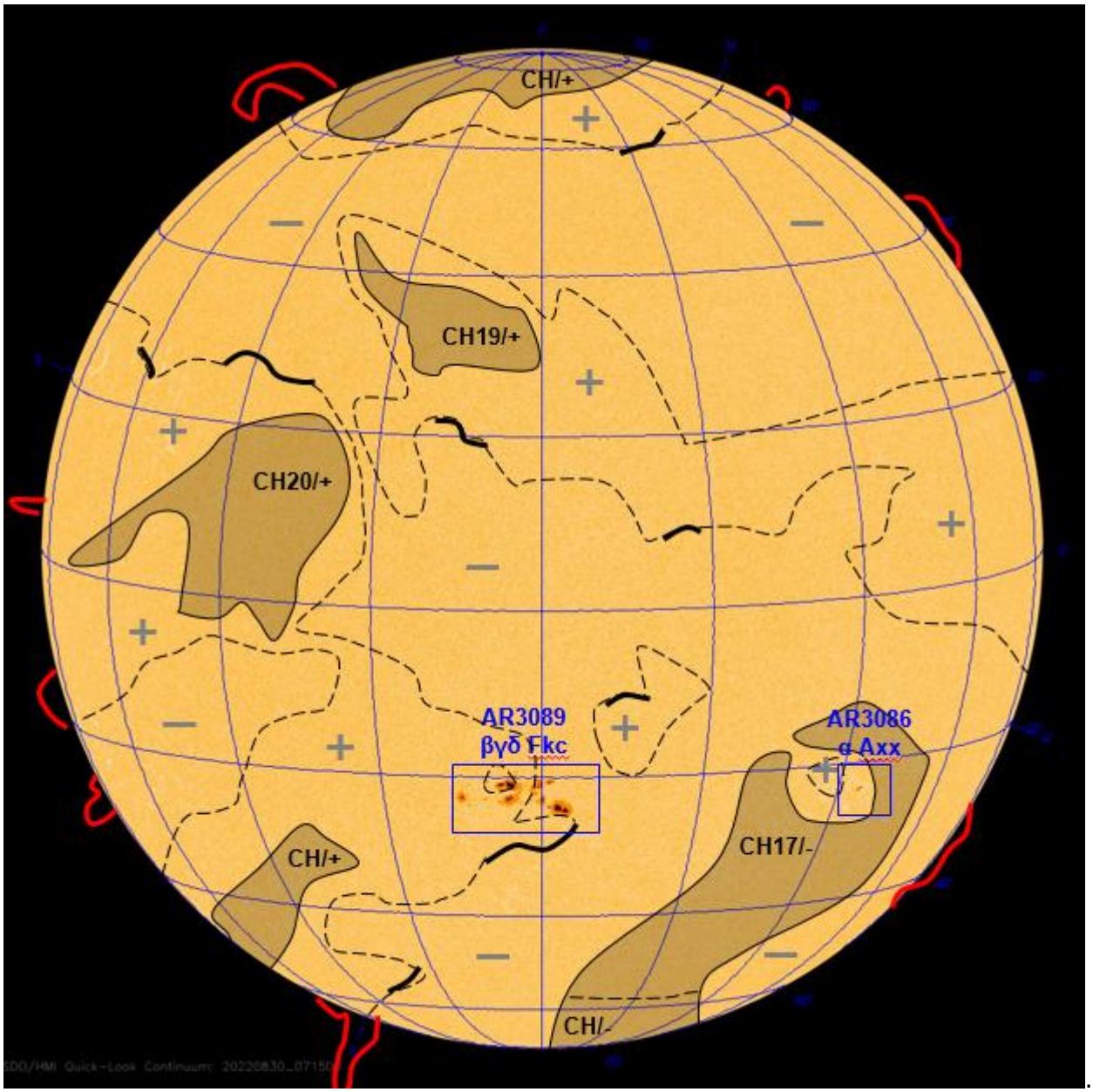
Figure 1. Solar Analysis Valid 30/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
There are no Earth directed CMEs currently forecast, but a filament eruption from south-centre disc will be analysed once sufficient coronagraph imagery becomes available.

Solar wind speeds have reached elevated levels in response to a high speed stream from coronal hole 17 in the southern hemisphere along with a possible contribution from a recent CME arrival. These winds are likely to remain elevated through days 1 and 2 (30 and 31 August), then likely falling to background during 01 and 02 September. The high speed stream from coronal hole 19 is then forecast to connect with Earth in 03 September, beyond the end of this forecast period.

Geomagnetic activity is forecast to be mainly Quiet, with isolated Unsettled intervals. There is a slight chance of Active intervals and a very slight chance of G1/Minor Storms, in the heightened solar wind speeds, during any periods of sustained negative Bz on days 1 and 2.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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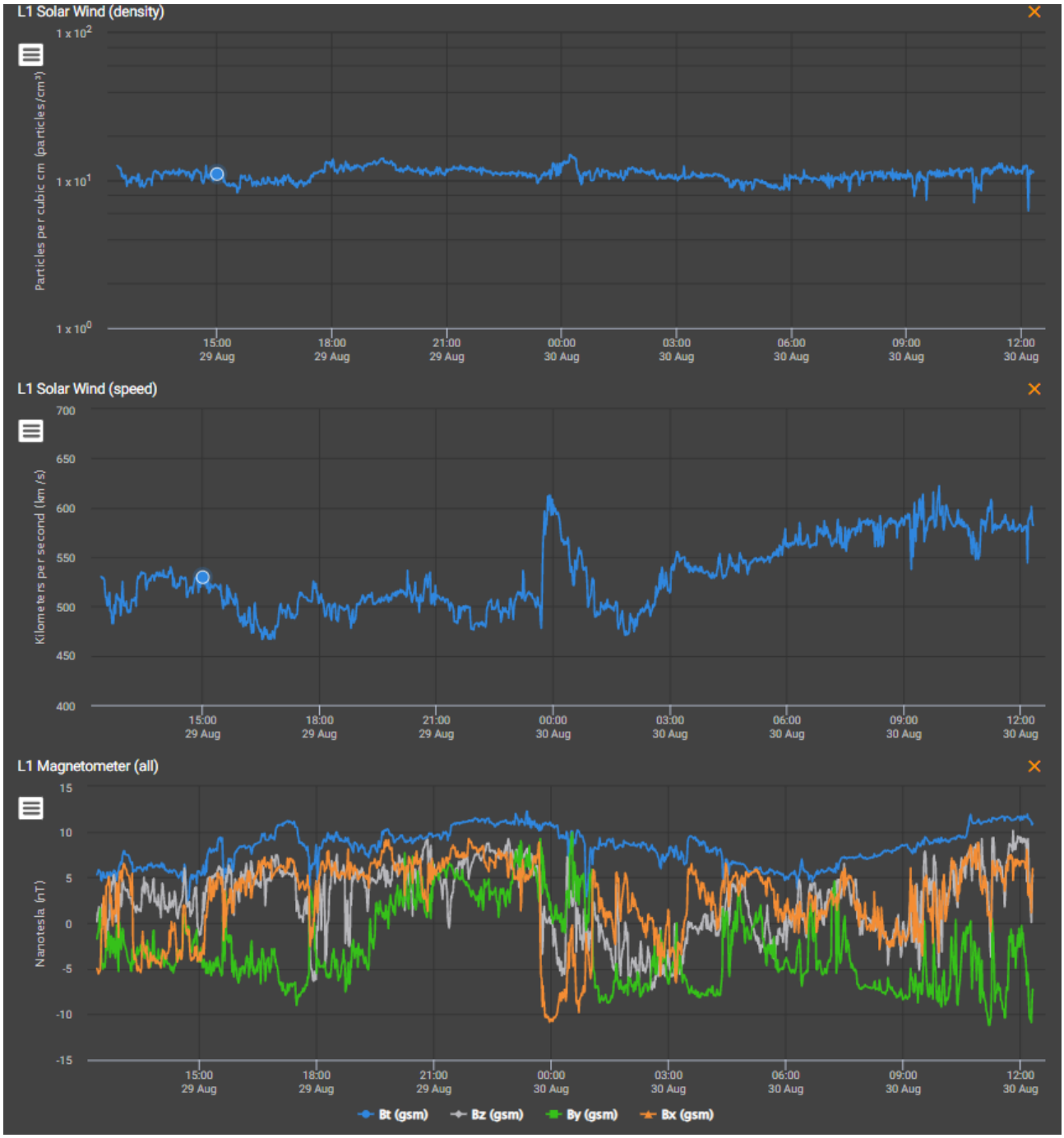
Figure 2: Recent solar wind parameter at L1.



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Radio Blackouts - X-Ray Flares:
Solar activity has been Moderate, with a chance of further Moderate activity through the forecast period.

The main source of solar activity has been ex-AR3088, which has rotated across the southwest limb, but with looping still protruding above the horizon, any flares will be visible at Earth. However the risk will decline through the next four days as evidence of the region rotates away from view.

On the visible disc, the most prominent feature is AR3089 in the south centre region. This is classified as a Ekc/Beta-Gamma-Delta and despite the magnetic arrangement, the looping appears to be organised, with no twisting or other complexities which would suggest any instability or heightened flare risk. Currently this region only gives a chance of M-class flares and a slight chance of X-class flaring.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: AR3089 (Ekc/Beta-Gamma-Delta) on the south central disc.

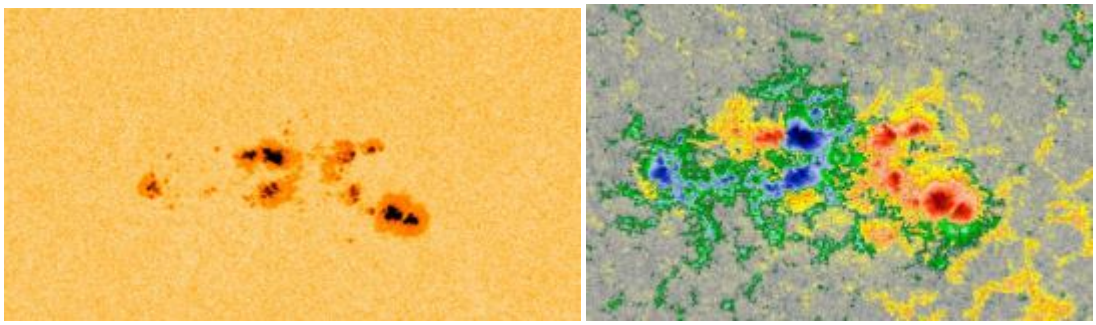

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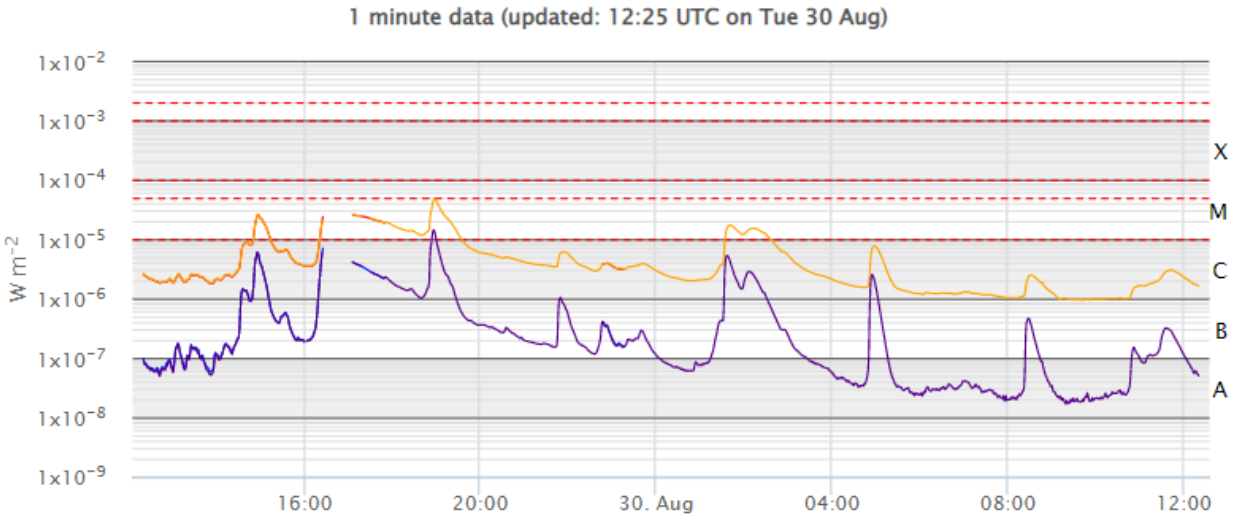
Figure 4: GOES-16 X-ray flux



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) is now at background values after recent enhancements. The continued influence of ex-AR3089 has led to a slight chance of the S1 level being reached through days 1 and 2 (30 and 31 August.

AR3089 (Ekc/Beta-Gamma-Delta) despite apparent stability, continues to present a risk of proton-rich flares should there be any significant flaring. This risk will continue as the region rotates across the southwestern quadrant.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV), is expected to remain at background values through much of the period, but potentially increasing to moderate or brief high values on diurnal peaks, with an increasing likelihood as the period progresses. There is a very slight chance of geomagnetic storming on days 1 and 2, which could inhibit any increases.

Electron fluence values are declining and are forecast to remain below the Active (1e8 integrated pfu) threshold throughout.

GEO Electron Environment	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	1

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